

INVESTIGATIONS ON BOBBLE—A SURFACE DEFECT IN SHEEP SKIN

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The leather making potentiality of Indian red hair sheep skins is appreciably affected by bobble—a surface defect generally prevalent during the winter months. Histopathological study of the bobble lesion tends to indicate that this disease may be of viral origin. In raw skin, the lesions are generally visible on the flesh side as round spots, but after unhairing they become more prominent on the grain side. A knowledge of the intensity of infection can be obtained only partly by visual examination of the raw skins. Bobble lesions leave permanent stains on both the chrome and vegetable tanned leathers and render them unsuitable for quality leathers. On some occasions grain damage takes place in the lesion affected area of skin. Physical properties of leathers are very little affected by bobble lesions. In heavily affected skins, the lesions are found to be distributed throughout the skin surface. The appearance of vegetable tanned leather produced from bobble-affected skins can be improved considerably by finishing them into printed leathers.

Sheep skins in India are affected in quality by a defect known in raw hide and skin trade as 'bobble'. A survey of the various surface defects in goat and sheep skins available at Perambur Slaughterhouse, Madras, showed¹ that 0.38% of the red hairy sheep skins are affected in quality due to 'bobble'. The incidence of the defect is comparatively higher during the winter months, i.e. from December to March, and it is found to be practically absent during the summer months, i.e. April to June. Red hairy sheep skins are found to be affected by bobble but not the goat skins. The leather making potentiality of sheep skin is appreciably affected depending on the size and the number of lesions present in the skin. This skin defect results in stained circular spots on both the sides of vegetable and chrome tanned leathers. In the trade,

bobble lesions are generally linked with pox lesions but they differ significantly with respect to their appearance in raw skin as well as in the finished leather. Investigations have been carried out on the effect of bobble lesions in raw skins and on the quality of leather and the results are presented in this paper.

Materials and methods

Tanning procedure

Red hair sheep skins, suspected to be affected by bobble, were collected from the slaughterhouse and then cured by salting.

The skins were taken in lots, tanned and finished into both chrome and vegetable tanned leathers according to conventional

methods. In order to overcome the deleterious effect of 'bobble' lesions, the vegetable tanned leathers were detanned by treating with borax, washed, treated with a syntan and then fatliquored, well set and dried. The leathers were finally finished as printed leather with a two-tone effect.

Histopathological study

Skin samples (1 sq. cm) affected by bobble lesions were cut out, fixed in 10% formalin, embedded in paraffin and sectioned ($5\ \mu$) in a rotary microtome. Sections were stained with haematoxylin and eosin², mounted in DPX and then examined microscopically.

Shrinkage temperature

Shrinkage temperature of collagen fibres from bobble affected and unaffected areas of skin was determined using a micro shrinkage meter and the values were expressed as °C.

Mean breaking length MBL and elongation of vegetable tanned collagen fibres

MBL and elongation were determined by using Instron tensile strength testing machine following the procedure as described earlier.³ MBL was expressed as km and elongation as percent.

Physical properties of chrome-tanned leathers

Tensile strength, elongation, stitch tear resistance and tongue tear resistance of bobble affected and unaffected chrome tanned leather were determined by Scott's tensile strength tester. SATRA grain crack and bursting strength values were determined using Lastometer. For the above tests, samples were cut out having the maximum number of bobble lesions in them, as they were not big enough for individual tests.

Counting of bobble lesions in skin

To facilitate counting of the bobble lesions, each skin was demarcated into right and left sides and both the sides were again marked into three areas, e. g. (i) neck and shoulder, (ii) lumbar and belly and (iii) butt. Lesions in the fore and hind legs were not taken into consideration. Counting was difficult in these areas as many of the lesions joined together forming patchy areas. Bobble lesions in each of the six areas of the skin as shown in Fig. 1 were counted in the raw stage, after liming and unhairing and after tanning i.e. in the chrome crust stage.

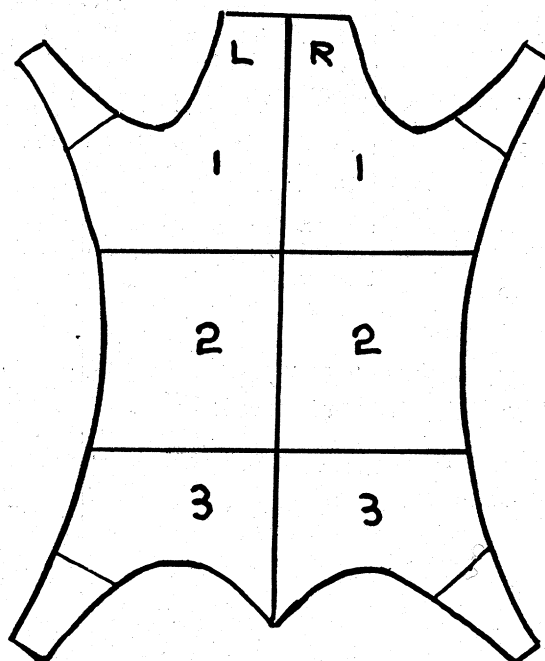


Fig. 1 Skin divided into six areas to facilitate counting of bobble lesions

Results

Histopathological study of bobble affected area of raw skin

The epidermis was stretched, the rete was the seat of intercellular and intracellular

oedema and there appeared to be moderate acanthosis with broadening of rete pegs. Oedematous rete cells (prickle cells) stained poorly and nuclei were pyknotic. Acidophilic cyto-plasmic inclusions were seen in a few cells. In a few cases there was proliferation of epidermis, particularly in the prickle cell layer. Parakeratosis and hyperkeratosis were also present.

There was lymphocytic invasion of the deeper layers of epidermis and well marked perivascular infiltration surrounding the vessels. The collagen fibres were separated by oedema and presented a fine, spongy, reticular structure, the fibres themselves were swollen and stained poorly.

Shrinkage temperature of collagen fibres

T_s of collagen fibres (30 nos) taken from bobble affected areas of 3 skins along with similar number of fibres from normal areas of the same skins was determined. The average T_s value of the affected fibres was 62°C whereas the corresponding value of the normal fibres was 61°C. Thus the hydro-thermal stability of the collagen fibres is practically unaffected by the bobble lesions.

Visual observations on the bobble lesions in skin and leather during processing

Raw skin

On the hair side of the skin the bobble lesions were hardly visible except in the belly and shank areas (sparsely covered by hair) where they appeared as slightly elevated circular lesions (Fig. 2). On the flesh side, however, they appeared as white circular lesions about 0.2 to 3.5 cm. in diameter (Fig. 3). When an affected skin was examined on a grading box, dark circular lesions were noted on the belly and shank areas where short hairs were present. It was also observed that hairs from the lesion affected areas

could be removed by plucking by hand. The lesions could be felt in between two fingers as a hard mass.

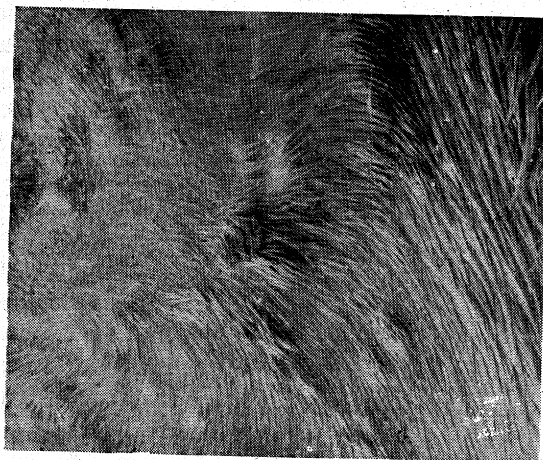


Fig. 2 Bobble lesions on the grain side (belly region) of red hairy sheep skin.

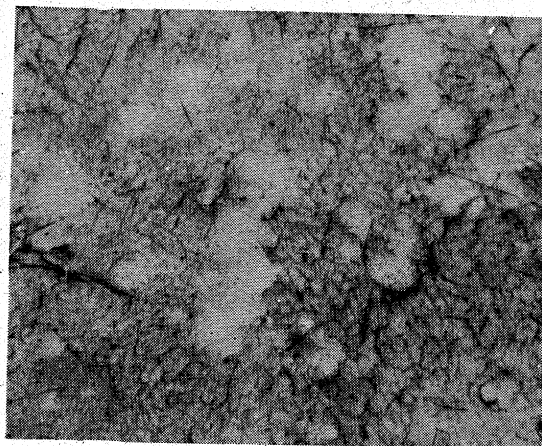


Fig. 3 Bobble lesions on the flesh side of red hairy sheep skin.

Limed pelt

Well developed circular lesions with rubbery feel were seen prominently on the grain side of the skin (Fig. 4). In many skins the lesions were uniformly distributed throughout the skin but in some cases they were mainly

present in the legs, neck, tail root and the lower parts of the butt areas. The central portion of the bigger lesions appeared to be darker in colour but no such variation was noted in smaller lesions. On the flesh side, the lesions were less prominent than on the grain side but after fleshing they were clearly visible. When examined on the grading box, some of the lesions appeared as circular white spots having a darker ring in the periphery. Bigger lesions gave slightly stiffer feel. In some skins few lesions were ruptured on the grain side possibly due to mechanical operations during unhairing and scudding. Otherwise no grain damage was observed in the lesion affected areas. In the leg areas, a number of lesions were coalesced together leading to irregular patchy areas.

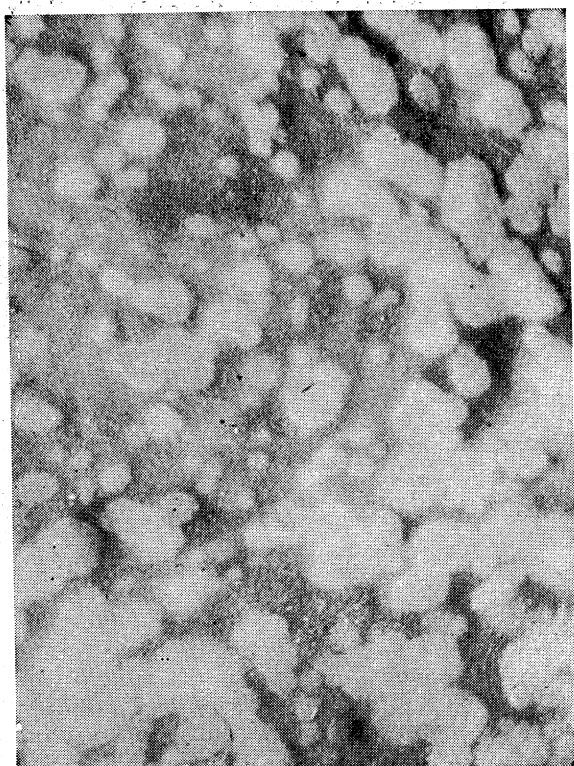


Fig. 4 Bobble lesions on the grain side of limed pelt.

Chrome crust

Bobble lesions were clearly visible on the grain side as well as on the flesh side. In the flesh side the lesions were lighter and on the grain side, comparatively darker in shade than on the corresponding unaffected areas of the leather. Lesion affected areas of the leather were slightly stiff compared to the unaffected areas. On the grain side, the affected areas were slightly rough and less smooth than the unaffected areas. Lesions on the grain side which appeared to be elevated after liming, were now level. On the flesh side, the lesion affected areas were slightly depressed and the uniformity of the nap was lacking.

Dyed and finished nappa leathers

After dyeing, the lesions appeared to be more prominent on both grain and flesh sides (Fig. 5). Such affected leathers were considered unsuitable for aniline finish or for finishing into lighter shades. Lesion affected areas were less smooth and somewhat rough on the grain. On the flesh side, areas corresponding to the lesions remained depressed. The periphery of the lesions appeared as deeply stained rings with a lighter shade in

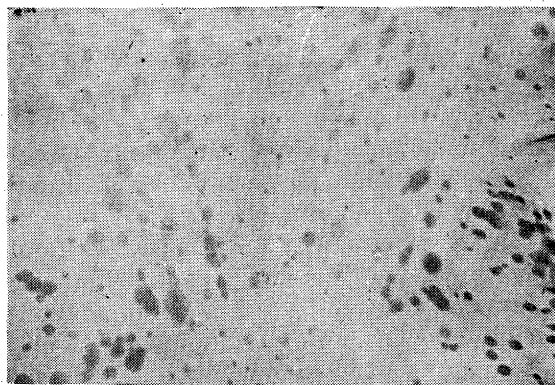


Fig. 5 Effect of bobble lesions on the grain side of dyed and finished nappa leather.

the middle. Such an appearance on the flesh side rendered the leathers unsuitable for suede finish.

Vegetable tanned leathers

The lesions appeared on the grain side as slightly elevated dark spots apparently causing no grain damage but the general appearance of the leathers was very poor (Fig. 6). On the flesh side, the lesions appeared as circular spots, slightly lighter in colour than on the unaffected areas. As such, bobble affected vegetable tanned leathers were considered unsuitable for making quality leathers.

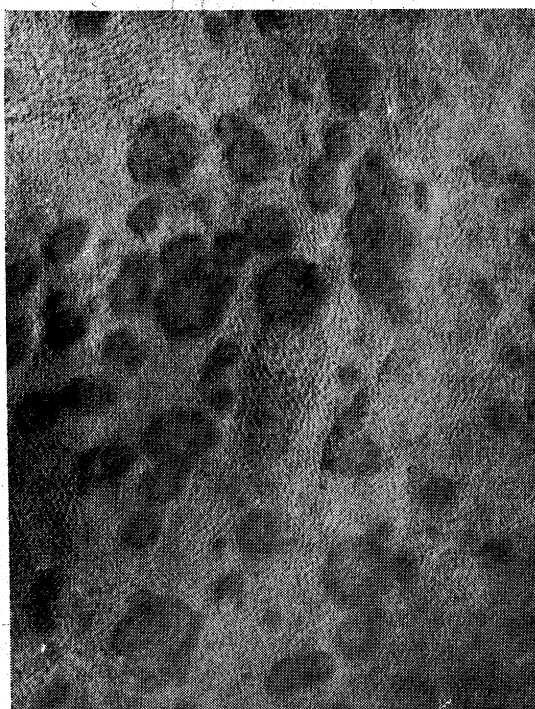


Fig. 6 Effect of bobble lesions on the grain side of vegetable tanned leather.

Finished printed leathers

Finishing vegetable tanned leathers as printed leathers gave good results because in

this case the lesions could be seen only slightly on the flesh side and on the grain side no lesion could be noted, as the coloured spots were covered well due to the printed and two-tone finish. Such leathers could conveniently be used for fancy leather articles.

MBL and elongation of vegetable tanned fibres

MBL and elongation of teased out fibres from vegetable-tanned leathers were determined and the results obtained are presented in Table 1.

TABLE 1

MBL and elongation of vegetable-tanned collagen fibres affected by bobble lesions

<i>Physical properties</i>	<i>Affected fibres</i>	<i>Unaffected fibres</i>
MBL (km)	1.777	3.730
Standard deviation	0.747	1.640
t value observed	3.62	
t value (theoretical) at 5% level	2.08	
Elongation (%)	15.93	16.94
Standard deviation	5.99	4.34
t value observed	1.91	
t value (theoretical) at 5% level	2.08	

The influence of bobble on the MBL of vegetable-tanned fibres appears to be statistically significant but its influence on elongation is not so.

Physical properties of chrome-tanned leathers

Physical properties of leathers affected by bobble lesions were determined and compared with those of unaffected leathers. The data obtained are presented in Tables 2 & 3

TABLE 2

Physical properties of chrome crust leathers affected by bobble

1. SATRA grain crack values												
Sample No	Control				Affected				Grain crack resistance (kg/cm. thickness)		Bursting resistance (kg/cm. thickness)	
	Grain crack		Bursting		Grain crack		Bursting		Control	Affected	Control	Affected
	Dis. (mm)	Load (kg)	Dis. (mm)	Load (kg)	Dis. (mm)	Load (kg)	Dis. (mm)	Load (kg)				
1.	9 . 50	22	10 . 20	28	9 . 30	18	10 . 0	22	275 . 0	225 . 0	350 . 0	275 . 0
2.	9 . 50	24	9 . 90	28	9 . 30	18	9 . 80	22	300 . 0	225 . 0	350 . 02	275 . 0
3.	9 . 60	16	10 . 60	24	9 . 20	12	10 . 20	20	200 . 0	133 . 0	300 . 0	250 . 0
4.	9 . 20	12	9 . 40	20	9 . 00	10	9 . 20	12	133 . 0	125 . 0	250 . 0	138 . 0
5.	9 . 00	20	10 . 90	26	8 . 50	18	9 . 90	20	250 . 0	225 . 0	325 . 0	250 . 0
6.	9 . 20	22	9 . 95	30	8 . 50	20	9 . 80	22	275 . 0	250 . 0	375 . 0	275 . 0
7.	9 . 70	18	10 . 55	27	9 . 50	14	10 . 35	22	225 . 0	175 . 0	337 . 5	275 . 0
8.	10 . 00	32	12 . 30	40	9 . 60	30	10 . 40	34	400 . 0	375 . 0	500 . 0	425 . 0
9.	10 . 00	26	12 . 00	28	9 . 50	22	9 . 80	26	325 . 0	275 . 0	350 . 0	325 . 0
10.	11 . 80	30	13 . 20	38	10 . 00	26	11 . 30	30	375 . 0	325 . 0	475 . 0	375 . 0
Av.	9 . 77	22 . 2	10 . 88	28 . 9	9 . 23	18 . 8	10 . 07	23	275 . 8	233 . 3	361 . 2	285 . 8

6 . 0 mm & below : Sub standard
 7 . 0 mm & below : satisfactory
 8 . 0 mm & above : very good.

SATRA grain crack and bursting strength values presented in the Table 2 are the average of 10 samples and the other physical properties are the average of 8 samples (Table 3).

TABLE 3

Physical properties of chrome crust leathers affected by bobble*

	Control	Affected.
1. Tensile strength (kg/sq.cm.)	179 . 4	163 . 8
2. Elongation (%)	47 . 8	40 . 0
3. Tongue tear resistance (kg/cm. thickness)	12 . 5	10 . 3
4. Stitch tear resistance (kg/cm. thickness)	91 . 3	77 . 9

* Average of 8 skins.

Comparatively lower values are obtained in case of bobble affected leather samples but the difference is not significant.

Counting of bobble lesions in different stages of processing

The number of bobble lesions detectable in raw skin, limed pelt and chrome crust were counted and the results obtained are presented in Table 4.

In red hair sheep skins, severely affected by bobble, about 459 lesions per skin (average of 10 skins) are detectable in the raw stage whereas, after liming and unhairing 1131 lesions are found to be present per skin which indicates that a significant proportion of the lesions are left unnoticed in the raw skin. In chrome crust, however, 1099 lesions per skin have been noted which points out that some of the minor lesions might have been covered up during processing.

Distribution of bobble lesions in different locations of the skin

A variation in lesion count in (i) neck and shoulder (ii) lumbar and belly and (iii) butt areas of the skin in raw, limed and chrome crust stage are shown in Table 5. Data presented are the average of 10 skins.

The above results indicate that the bobble lesions develop throughout the skin and not much variation is noted in the number of bobble lesions in different locations of the skin.

Discussion

Histopathological study of the bobble lesions in red hair sheep skin indicates that the lesions might be of viral origin. Necrotic and proliferative changes of the epidermis and oedema and infiltration of the dermis are characteristic features of viral infection.⁴

The hydrothermal stability of the collagen fibres in the lesion affected areas is found to be higher by 1°C which points out that the internal structure of the collagen fibre is not affected by bobble lesions.

Changes taking place in bobble affected areas of skins have been noted during their processing. The lesions vary in size appreciably with the age of the lesions and the stage of formation. The developed lesions can be felt in between the fingers and their action on skin quality is indicated by their hair loosening effect. In raw skin the lesions are generally visible on the flesh side.

After liming and unhairing, however, the lesions become prominent on the grain side as slightly raised circular spots. After fleshing, they are better exposed. In some cases, mechanical operations resulted in the rupture of the grain in the lesion affected areas.

TABLE 4

Detectable 'bobble' lesions in skin in different stages of processing

<i>Sample No.</i>	<i>No. of lesions in raw skin</i>	<i>No. of lesions in un haired pelt</i>	<i>% increase in count in un haired pelt from that of raw skin</i>	<i>No. of lesions in chrome crust</i>	<i>% increase in count in chrome crust from that of raw skin</i>
1.	483	1277	164 . 38	1254	159 . 62
2.	560	1360	142 . 85	1320	135 . 71
3.	588	1366	132 . 21	1324	125 . 17
4.	566	1136	100 . 70	1095	93 . 46
5.	417	845	102 . 63	829	98 . 00
6.	297	693	133 . 33	661	122 . 55
7.	395	1059	168 . 10	1019	157 . 97
8.	433	859	98 . 31	840	93 . 99
9.	474	1535	223 . 83	1508	218 . 14
10.	376	1182	214 . 36	1141	203 . 45
Average	458 . 9	1131 . 2	148 . 08	1099 . 1	140 . 81

TABLE 5

Variation in count of the bobble lesions in different locations of skin.

<i>Location in skin</i>	<i>Raw skin</i>		<i>Limed pelt</i>		<i>Chrome crust</i>	
	<i>R</i>	<i>L</i>	<i>R</i>	<i>L</i>	<i>R</i>	<i>L</i>
Neck and shoulder	71 . 1	85 . 3	198 . 5	194 . 7	192 . 5	189 . 0
Lumbar & belly	73 . 5	77 . 2	171 . 6	162 . 1	167 . 4	153 . 7
Butt	71 . 3	80 . 5	198 . 4	205 . 1	193 . 8	202 . 7

In tanned and finished nappa leathers, the lesions are distinctly visible on both the sides. They are to some extent stiff and rough on the grain and slightly depressed on the flesh side. Such bobble affected skins are unsuitable for quality chrome or vegetable tanned leathers. However, they can be made usable by converting them into printed leathers having a two-tone affect.

The influence of bobble on MBL of vegetable tanned collagen fibres appears to be significant. As regards the physical properties of chrome crust leathers, not much variation is noted between the control and bobble affected areas of leather. Data presented in Table 4 give some important indications. It is not possible to have a clear understanding about the number of lesions present in raw skin by visual examination, as many of the lesions remain concealed beneath the hair. It is only after unhairing, a clear picture is revealed and about 148% increase in the number of lesions from that of raw count is noted. In chrome crust, however, 140% increase in the lesions is noted i.e. about 8% reduction from that of limed pelt count. Smaller lesions, which impart little influence on skin may have been covered up in the crust stage thus reducing the number of visible lesions.

In most of the cases of bobble, lesions are found to be distributed throughout the skin surface more or less uniformly (Table 5).

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REFERENCES

1. Venkatesan, R. A., Sugumar, M., Nandy, S. C. & Santappa, M., *Leather Sci*, **24**, 255 (1977).
2. Culling, C. F. A., *Hand book of Histopathological and Histochemical technique*, 3rd Ed. (1974) Butterworths, London.
3. Nedunchellian, S., Sugumar, M. & Nandy, S. C., (Communicated to *Leather Science*).
4. Landells, J. L., *Essential Principles of Pathology* (1959), Pitman Medical Pub. Co. Ltd, London.